REMARKS

Claims 7-11 are pending. Claim 10 has been amended.

The following remarks are made in response to a Final Office Action dated February 6, 2007, in which the Examiner:

rejected claim 8 under 35 USC § 112, paragraph 2, for insufficient antecedent basis;

rejected claims 7, 8 and 10-11 under 35 USC § 102(b) as being anticipated by US Patent No. 6,202,230 to Borders ("Borders I"); and

rejected claim 9 under 35 USC § 103(a) as being unpatentable over Borders I in view of US Patent No. 5,157,800 to Borders ("Borders II").

Applicants thank the Examiner for the courtesy of the telephonic interview on March 26, 2007, wherein the Applicants understanding of a parallelogram joint (with reference to paragraph [0025], FIG. 5 and claim 1) was discussed.

Applicants believe that the Examiner's rejection of claim 8 for insufficient antecedent basis is in error and that the rejection should be applied to claim 10. Claim 8 does not recite "the lower leg strut," whereas claim 10 does. Applicants have amended claim 10 to depend from claim 9, thereby supplying proper antecedent basis.

<u>Claims 7, 8 and 10-11</u>

The Examiner rejected claims 7, 8 and 10-11 as being anticipated by Borders I. Claim 7, which is the only independent claim, is directed to a leg support arrangement for an operating table. Claim 7 recites, at least in part, that each leg support is connected with the base element by means of a parallelogram joint. Each leg support includes an upper leg support and a lower leg support. The joint axes of the parallelogram joint are oriented perpendicular to the plane of the base element. Each upper leg support is connected with a connecting piece by two parallelogram joint forming links, to which connecting piece the first ends of the links are pivotally connected. The connecting piece is pivotally connected

with the base element for movement about the horizontal folding axis for the upper leg support. The second ends of the two parallelogram joint links are pivotally connected to the upper leg support onto which the folding joint for the lower leg support is formed.

Applicants respectfully submit that the ordinary meaning of the claim terms "parallelogram joint" and "links" should be applied. According to MPEP 2111.01, during examination the claims must be interpreted as broadly as their terms reasonably allow, and this means that the words of the claim must be given their plain meaning unless the plain meaning is inconsistent with the specification. The ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art. Further, the ordinary and customary meaning of a term may be evidenced by a variety of sources, including the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence. Indeed, "claims are not to be read in a vacuum, and limitations therein are to be interpreted in light of the specification in giving them their 'broadest reasonable interpretation'." (*In re Marosi*, 710 F.2d 799, 802, 218 USPQ 289, 292 (Fed. Cir. 1983), internal citations omitted, emphasis in original.)

In this regard, Applicants submit that a "parallelogram joint" is a well-known type of four-bar linkage joint, in which the orientation of the coupler link remains unchanged during motion—in other words, the coupler link moves parallel to its original position. (See, for example, a Carnegie Mellon University website, www.cs.cmu.edu/~rapidproto//mechanisms/chpt5.html, Subsection 5.2.1 Examples, Parallelogram Mechanism (copy supplied) and US Patent No. 5,374,050, Abstract, et al.) Furthermore, Applicants submit that the term "link" is also well known in the art as being a rigid body connected to other links at joints, where a joint allows relative movement between the links. In paragraph [0025] of the specification in conjunction with FIG. 5, Applicants disclose that "[t]he two links 34 and 50 form with their joint axes 36, 52 and 44, 54 a parallelogram joint, by means of which the connecting member 42 and with it the upper leg plate 46 can be adjusted parallel to itself without it changing its orientation in space."

Thus, consistent with these well known understandings of the terms "parallelogram joint" and "links," the specification explicitly discloses that the phrase "parallelogram joint" used in claim 1 includes links joined at axes 36, 52, 44 and 54 such that the upper leg plate can move parallel to itself. In light of the above, Applicants respectfully request that the Examiner give the terms "parallelogram joint" and "links" their ordinary and customary meaning as evidence by the specification and the extrinsic evidence presented herein.

The Examiner has indicated that Borders I discloses that "each leg support is connected with the base element (14,16) by means of a parallelogram joint is defined by post 106 (fig. 11) wherein vertical joint axes (90, 92) (fig. 6) are oriented perpendicular to the horizontal plane of the seat section of base." The Examiner further asserts that "each upper leg support is connected with a connecting piece defined by the first frame section 88 by two parallelogram joint forming links defined by a clevis 100, to which connecting piece the first ends of the links are pivotally connected."

Applicants disagree, and respectfully assert that Borders I fails to disclose that a parallelogram joint connects each leg support to the base element. A parallelogram joint would allow the leg support to move parallel to itself relative to the base element. Borders I fails to disclose a joint that allows the leg support to move parallel to itself without changing orientation. Rather, referring to FIG. 13, Borders I discloses that each leg support 84/88 is connected to seat section 22 with a horizontal pivot joint (around axis 112), a vertical pivot joint (around post 106), and a second horizontal pivot joint (around axis 48). By themselves, or taken all together, these joints connecting the leg support 84/88 of Borders I to the seat section 22 cause the leg support to change orientation as it is moved. Thus, contrary to the Examiner's assertion, Applicants submit that the vertical pivot joint around post 106 does not constitute a parallelogram joint, as would be understood by persons of ordinary skill in the art and as defined in the specification with reference to paragraph [0025] and FIG. 5.

Applicants further submit that clevis 100 does not define two

parallelogram joint forming links. As noted above, a link is a rigid body connected to other links at joints. At most clevis 100 forms a single link, as clevis 100 is a single rigid body. Thus, it is not possible, given the ordinary and customary meaning of the term "link," for clevis 100 to define <u>two</u> parallelogram forming links.

Furthermore, claim 1 requires that the parallelogram joint axes be oriented perpendicular to the plane of the base element. Claim 1 also requires that each upper leg support is connected with a connecting piece by two parallelogram joint forming links, to which connecting piece the first ends of the links are pivotally connected and that the second ends of the two parallelogram joint links are pivotally connected to the upper leg support. Borders I discloses that clevis 100 pivots around a vertical post 106 and is coupled to frame section 88 via horizontal pivot axis 48 (see FIG. 13). If, *arguendo*, one were to consider the clevis 100 of Borders I to be the two parallelogram joint forming links (as indicated by the Examiner), then the parallelogram joint axes would be the vertical axis 90 (or 92) associated with vertical post 106 and the horizontal axis 48. Although vertical axis 90/92 is perpendicular to the plane of seat section 22, horizontal axis 48 is <u>not</u> perpendicular to seat section 22. Therefore, even if, *arguendo*, clevis 100 was considered to be the two parallelogram joint forming links (which Applicants refute), the joint axes are not oriented perpendicular to the plane of the base element, as required by claim 1.

<u>Claim 9</u>

The Examiner rejected claim 9 as being unpatentable over Borders I in view of Borders II. Claim 9 depends from claim 7 and contains additional recitations thereto. Applicants respectfully submit that Borders II also fails to disclose a parallelogram joint as required by claims 7 and 9, and thus, that Borders II fails to cure the deficiencies of Borders I.

As Applicants have traversed each and every rejection and objection raised by the Examiner, Applicants respectfully request allowance of claims 7-11.

Should the Examiner withdraw the present rejections without allowing the claims, Applicants respectfully request that the Examiner withdraw the finality of the present office action.

Applicants believe no fees are due with the filing of this Response; however, if it is determined that fees are required, please charge our Deposit Account No. 13-0235.

Respectfully submitted,

By

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Rapid Design through Virtual and Physical Prototyping

Carnegie Mellon University

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Introduction to Mechanisms

Yi Zhang
with
Susan Finger
Stephannie Behrens

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5 Planar Linkages

5.1 Introduction

5.1.1 What are Linkage Mechanisms?

Have you ever wondered what kind of mechanism causes the wind shield wiper on the front widow of car to oscillate (Figure 5-1a)? The mechanism, shown in Figure 5-1b, transforms the rotary motion of the motor into an oscillating motion of the windshield wiper.

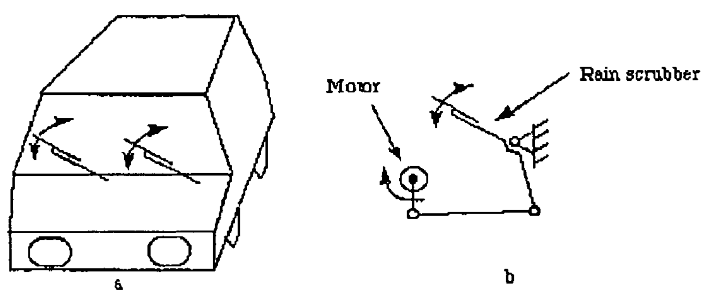

Figure 5-1 Windshield wiper

Let's make a simple mechanism with similar behavior. Take some cardboard and make four strips as shown in Figure 5-2a.

Take 4 pins and assemble them as shown in Figure 5-2b.

Now, hold the 6in. strip so it can't move and turn the 3in. strip. You will see that the 4in. strip oscillates.

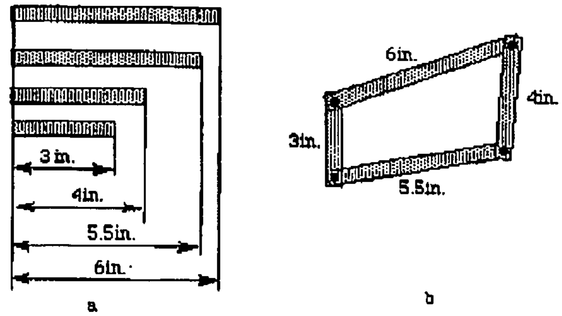

Figure 5-2 Do-it-yourself four bar linkage mechanism

The four bar linkage is the simplest and often times, the most useful mechanism. As we mentioned before, a mechanism composed of rigid bodies and lower pairs is called a linkage (Hunt 78). In planar mechanisms, there are only two kinds of lower pairs --- revolute pairs and prismatic pairs.

The simplest closed-loop linkage is the four bar linkage which has four members, three moving links, one fixed link and four pin joints. A linkage that has at least one fixed link is a mechanism. The following example of a four bar linkage was created in SimDesign in `simdesign/fourbar.sim`

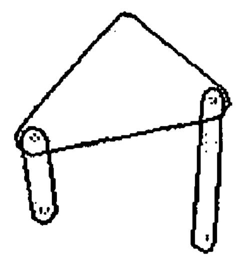

Figure 5-3 Four bar linkage in SimDesign

This mechanism has three moving links. Two of the links are pinned to the frame which is not shown in this picture. In SimDesign, links can be nailed to the background thereby making them into the frame.

How many DOF does this mechanism have? If we want it to have just one, we can impose one constraint on the linkage and it will have a definite motion. The four bar linkage is the simplest and the most useful mechanism.

Reminder: A mechanism is composed of rigid bodies and lower pairs called linkages (Hunt 78). In planar mechanisms there are only two kinds of lower pairs: turning pairs and prismatic pairs.

5.1.2 Functions of Linkages

The function of a link mechanism is to produce rotating, oscillating, or reciprocating motion from the rotation of a crank or *vice versa* (Ham et al. 58). Stated more specifically linkages may be used to convert:

1. Continuous rotation into continuous rotation, with a constant or variable angular velocity ratio.
2. Continuous rotation into oscillation or reciprocation (or the reverse), with a constant or variable velocity ratio.
3. Oscillation into oscillation, or reciprocation into reciprocation, with a constant or variable velocity ratio.

Linkages have many different functions, which can be classified according on the primary goal of the mechanism:

- **Function generation**: the relative motion between the links connected to the frame,
- **Path generation**: the path of a tracer point, or
- **Motion generation**: the motion of the coupler link.

5.2 Four Link Mechanisms

One of the simplest examples of a constrained linkage is the *four-link mechanism*. A variety of useful mechanisms can be formed from a four-link mechanism through slight variations, such as changing the character of the pairs, proportions of links, *etc*. Furthermore, many complex link mechanisms are combinations of two or more such mechanisms. The majority of four-link mechanisms fall into one of the following two classes:

1. the four-bar linkage mechanism, and
2. the slider-crank mechanism.

5.2.1 Examples

Parallelogram Mechanism

In a parallelogram four-bar linkage, the orientation of the coupler does not change during the motion. The figure illustrates a loader. Obvioulsy the behavior of maintaining parallelism is important in a loader. The bucket should not rotate as it is raised and lowered. The corresponding SimDesign file is `simdesign/loader.sim`.

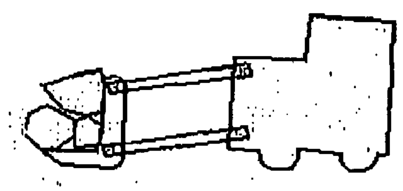

Figure 5-4 Front loader mechanism

Slider-Crank Mechanism

The four-bar mechanism has some special configurations created by making one or more links infinite in length. The slider-crank (or crank and slider) mechanism shown below is a four-bar linkage with the slider replacing an infinitely long output link. The corresponding SimDesign file is `simdesign/slider.crank.sim`.

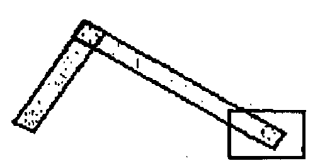

Figure 5-5 Crank and Slider Mechanism

This configuration translates a rotational motion into a translational one. Most mechanisms are driven by motors, and slider-cranks are often used to transform rotary motion into linear motion.

Crank and Piston

You can also use the slider as the input link and the crank as the output link. In this case, the mechanism transfers translational motion into rotary motion. The pistons and crank in an internal combustion engine are an example of this type of mechanism. The corresponding SimDesign file is `simdesign/combustion.sim`.

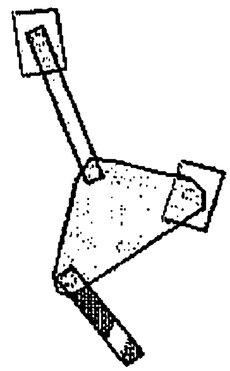

Figure 5-6 Crank and Piston

You might wonder why there is another slider and a link on the left. This mechanism has two dead points. The slider and link on the left help the mechanism to overcome these dead points.

Block Feeder

One interesting application of slider-crank is the block feeder. The SimDesign file can be found in `simdesign/block-feeder.sim`

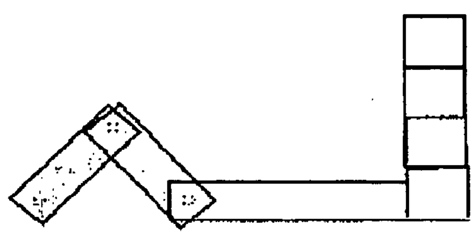

Figure 5-7 Block Feeder

5.2.2 Definitions

In the range of planar mechanisms, the simplest group of lower pair mechanisms are four bar linkages. A ***four bar linkage*** comprises four bar-shaped links and four turning pairs as shown in Figure 5-8.

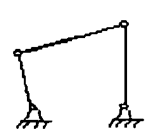

Figure 5-8 Four bar linkage

The link opposite the frame is called the **coupler link**, and the links whick are hinged to the frame are called **side links**. A link which is free to rotate through 360 degree with respect to a second link will be said to **revolve** relative to the second link (not necessarily a frame). If it is possible for all four bars to become simultaneously aligned, such a state is called a **change point**.

Some important concepts in link mechanisms are:

1. **Crank**: A side link which revolves relative to the frame is called a *crank*.
2. **Rocker**: Any link which does not revolve is called a *rocker*.
3. **Crank-rocker mechanism**: In a four bar linkage, if the shorter side link revolves and the other one rocks (*i.e.*, oscillates), it is called a *crank-rocker mechanism*.
4. **Double-crank mechanism**: In a four bar linkage, if both of the side links revolve, it is called a *double-crank mechanism*.
5. **Double-rocker mechanism**: In a four bar linkage, if both of the side links rock, it is called a *double-rocker mechanism*.

5.2.3 Classification

Before classifying four-bar linkages, we need to introduce some basic nomenclature.

In a four-bar linkage, we refer to the *line segment between hinges* on a given link as a **bar** where:

- s = length of shortest bar
- l = length of longest bar
- p, q = lengths of intermediate bar

Grashof's theorem states that a four-bar mechanism has *at least* one revolving link if

$$s + l <= p + q \tag{5-1}$$

and all three mobile links will rock if

$$s + l > p + q \tag{5-2}$$

The inequality 5-1 is **Grashof's criterion**.

All four-bar mechanisms fall into one of the four categories listed in Table 5-1:

Case	l + s vers. p + q	Shortest Bar	Type
1	<	Frame	Double-crank
2	<	Side	Rocker-crank
3	<	Coupler	Doubl rocker
4	=	Any	Change point
5	>	Any	Double-rocker

Table 5-1 Classification of Four-Bar Mechanisms

From Table 5-1 we can see that for a mechanism to have a crank, the sum of the length of its shortest and longest links must be less than or equal to the sum of the length of the other two links. However, this condition is necessary but not sufficient. Mechanisms satisfying this condition fall into the following three categories:

1. When the shortest link is a side link, the mechanism is a crank-rocker mechanism. The shortest link is the crank in the mechanism.
2. When the shortest link is the frame of the mechanism, the mechanism is a double-crank mechanism.
3. When the shortest link is the coupler link, the mechanism is a double-rocker mechanism.

5.2.4 Transmission Angle

In Figure 5-11, if *AB* is the input link, the force applied to the output link, *CD*, is transmitted through the coupler link *BC*. (That is, pushing on the link *CD* imposes a force on the link *AB*, which is transmitted through the link *BC*.) For sufficiently slow motions (negligible inertia forces), the force in the coupler link is pure tension or compression (negligible bending action) and is directed along *BC*. For a given force in the coupler link, the torque transmitted to the output bar (about point *D*) is maximum when the angle β between coupler bar *BC* and output bar *CD* is $\pi/2$. Therefore, angle BCD is called **transmission angle**.

$$\alpha_{max} = |90^\circ - \beta|_{min} < 50^\circ \tag{5-3}$$

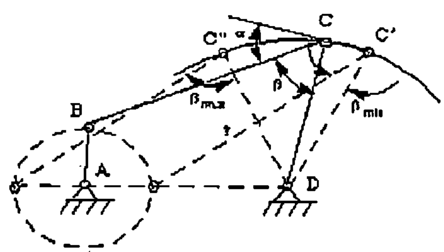

Figure 5-11 Transmission angle

When the *transmission angle* deviates significantly from $\pi/2$, the torque on the output bar decreases and may not be sufficient to overcome the friction in the system. For this reason, the **deviation angle** $\alpha=|\pi/2-\beta|$ should not be too great. In practice, there is no definite upper limit for α, because the existence of the inertia forces may eliminate the undesirable force relationships that is present under static conditions. Nevertheless, the following criterion can be followed.

5.2.5 Dead Point

When a side link such as *AB* in Figure 5-10, becomes aligned with the coupler link *BC*, it can only be compressed or extended by the coupler. In this configuration, a torque applied to the link on the other side, *CD*, cannot induce rotation in link *AB*. This link is therefore said to be at a **dead point** (sometimes called a **toggle point**).

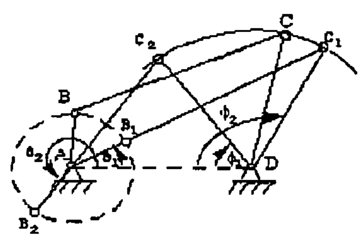

Figure 5-10 Dead point

In Figure 5-11, if *AB* is a crank, it can become aligned with BC in full extension along the line AB_1C_1 or in flexion with AB_2 folded over B_2C_2. We denote the angle *ADC* by φ and the angle DAB by θ. We use the subscript 1 to denote the extended state and 2 to denote the flexed state of links *AB* and *BC*. In the extended state, link *CD* cannot rotate clockwise without stretching or compressing the theoretically rigid line AC_1. Therefore, link *CD* cannot move into the *forbidden zone* below C_1D, and φ must be at one of its two extreme positions; in other words, link *CD* is at an extremum. A second extremum of link *CD* occurs with $\varphi = \varphi_1$.

Note that the extreme positions of a side link occur simultaneously with the dead points of the opposite link.

In some cases, the dead point can be useful for tasks such as work fixturing (Figure 5-11).

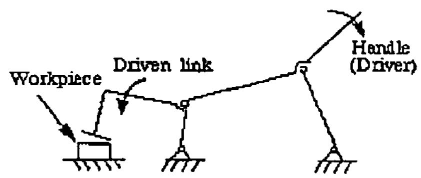

Figure 5-11 Work fixturing

In other cases, dead point should be and can be overcome with the moment of inertia of links or with the asymmetrical deployment of the mechanism (Figure 5-12).

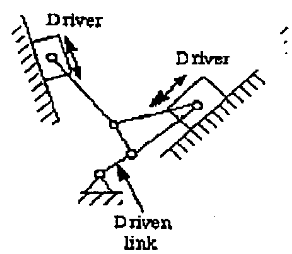

Figure 5-12 Overcoming the dead point by asymmetrical deployment (V engine)

5.2.6 Slider-Crank Mechanism

The slider-crank mechanism, which has a well-known application in engines, is a special case of the crank-rocker mechanism. Notice that if rocker 3 in Figure 5-13a is very long, it can be replaced by a block sliding in a curved slot or guide as shown. If the length of the rocker is infinite, the guide and block are no longer curved. Rather, they are apparently straight, as shown in Figure 5-13b, and the linkage takes the form of the ordinary **slider-crank mechanism**.

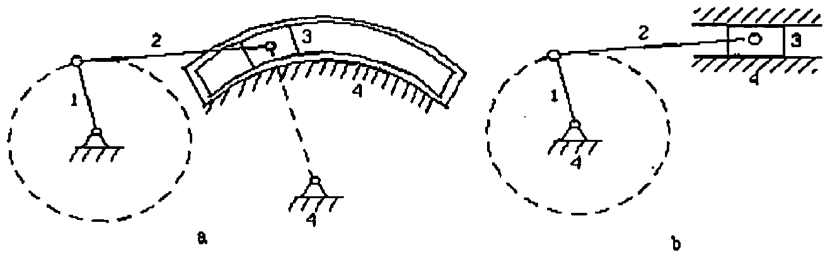

Figure 5-13 Slider-Crank mechanism

5.2.7 Inversion of the Slider-Crank Mechanism

Inversion is a term used in kinematics for a reversal or interchange of form or function as applied to kinematic chains and mechanisms. For example, taking a different link as the fixed link, the slider-crank mechanism shown in Figure 5-14a can be inverted into the mechanisms shown in Figure 5-14b, c, and d. Different examples can be found in the application of these mechanisms. For example, the mechanism of the pump device in Figure 5-15 is the same as that in Figure 5-14b.

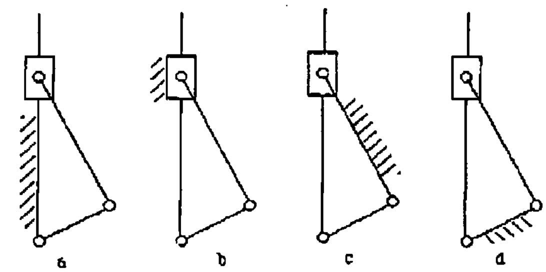

Figure 5-14 Inversions of the crank-slide mechanism

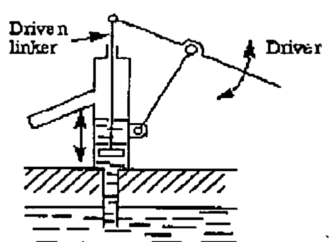

Figure 5-15 A pump device

Keep in mind that the inversion of a mechanism does not change the motions of its links relative to each other but does change their absolute motions.

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sfinger@ri.cmu.edu

US005374050A

United States Patent [19]

Prim

[11] Patent Number: 5,374,050

[45] Date of Patent: Dec. 20, 1994

[54] JOGGER HAVING A FLOATING MOUNT

[75] Inventor: John E. Prim, West Chazy, N.Y.

[73] Assignee: Prim Hall Enterprises, Inc., Plattsburgh, N.Y.

[21] Appl. No.: 71,530

[22] Filed: Jun. 3, 1993

[51] Int. Cl.^{5} B65H 31/36

[52] U.S. Cl. 271/221; 271/223; 414/917

[58] Field of Search 271/149, 150, 213, 221, 271/222, 223; 414/917

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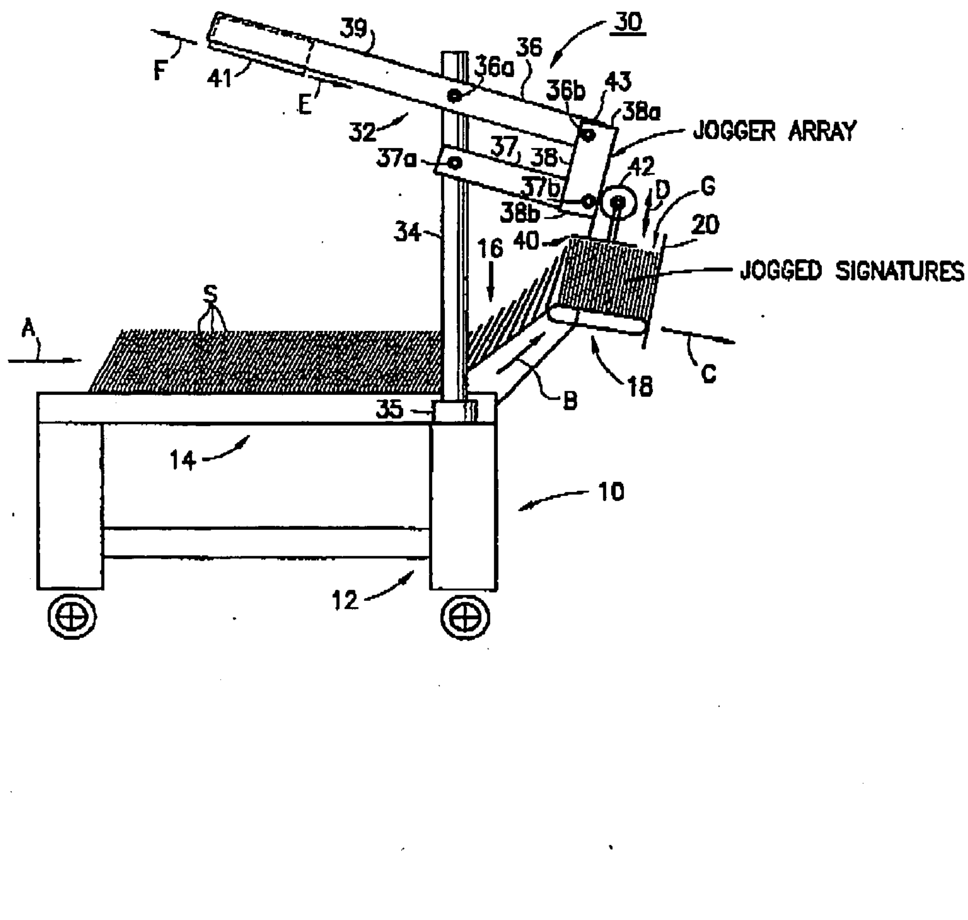
Primary Examiner—Robert P. Olszewski
Assistant Examiner—Boris Milef
Attorney, Agent, or Firm—Louis Weinstein

[57] ABSTRACT

A jogger having a jogger plate is floatingly supported by a four-bar linkage swingably mounted upon a support post. The four-bar linkage is a parallelogram-type linkage which enables the jogger plate to maintain its orientation in space regardless of any swinging movement experienced by the parallelogram linkage. An adjustable weight is provided to control the force exerted upon a signature stack during operation. The jogger plate is adjustable to provide proper positioning of the plate relative to the stack being jogged into alignment. Sensors control the operation of the jogger assembly responsive to the presence of a stack to be jogged and responsive to the movement of the jogging assembly to a given position displaced from the nominal operating position.

20 Claims, 5 Drawing Sheets



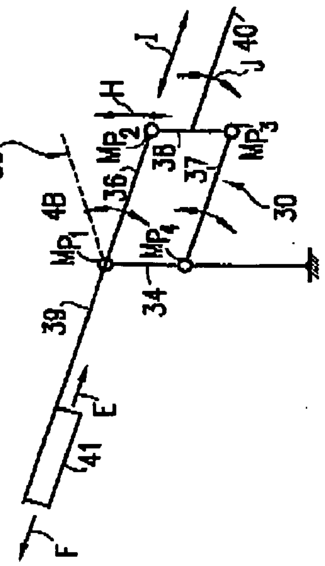

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Fig. 1a

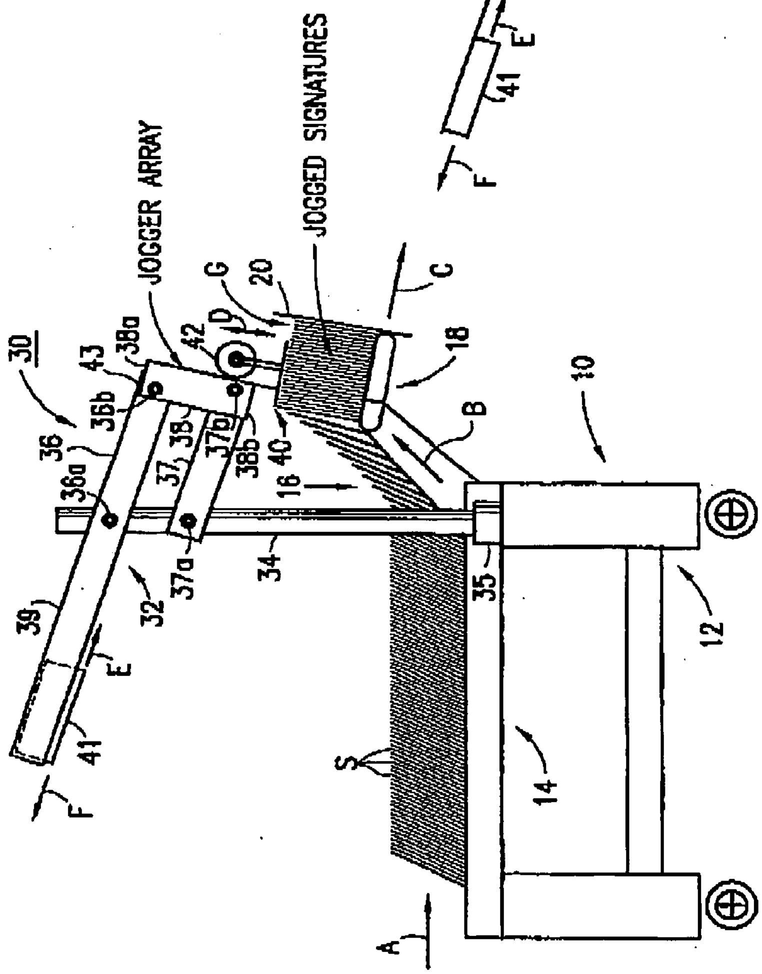
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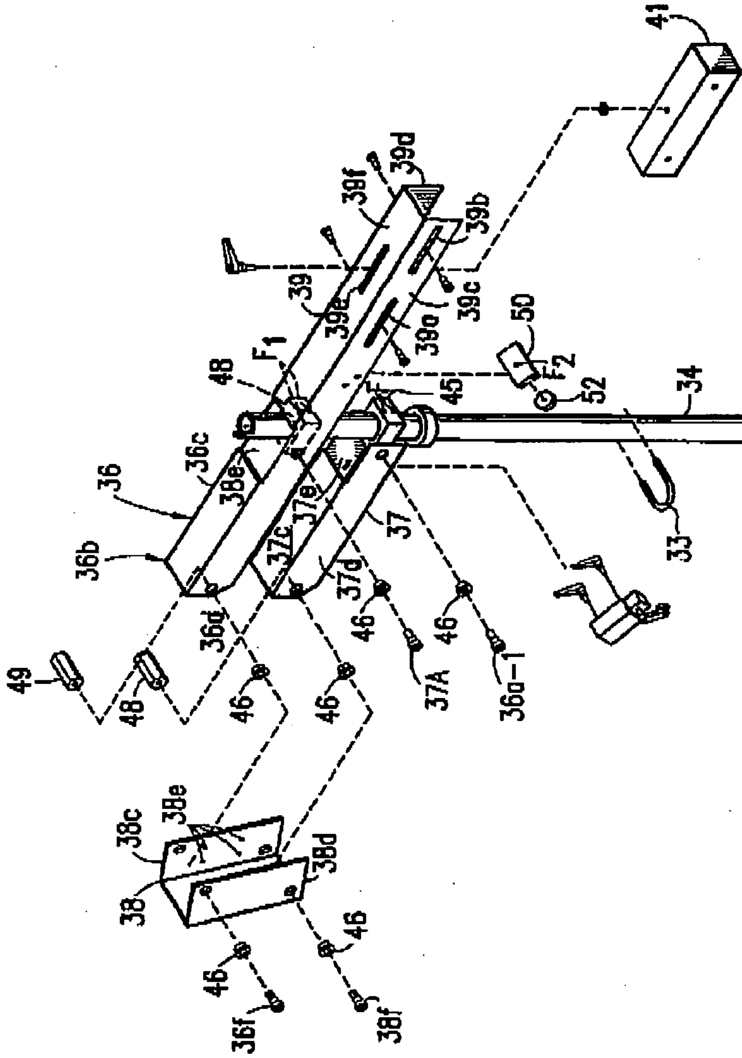
Fig. 1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38
38d
36f
38f

Fig. 2a

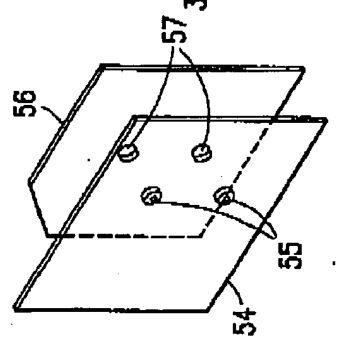
56
57
55
54

Fig. 2c

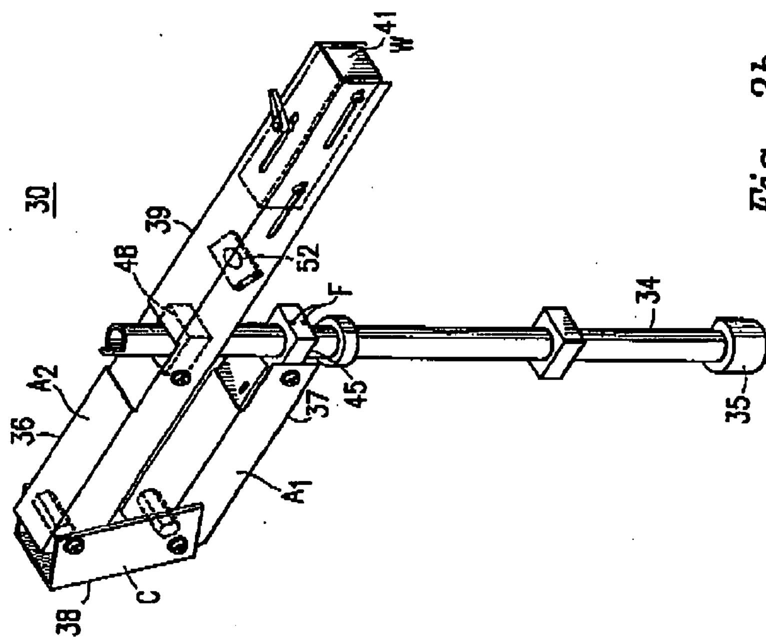

Fig. 2b

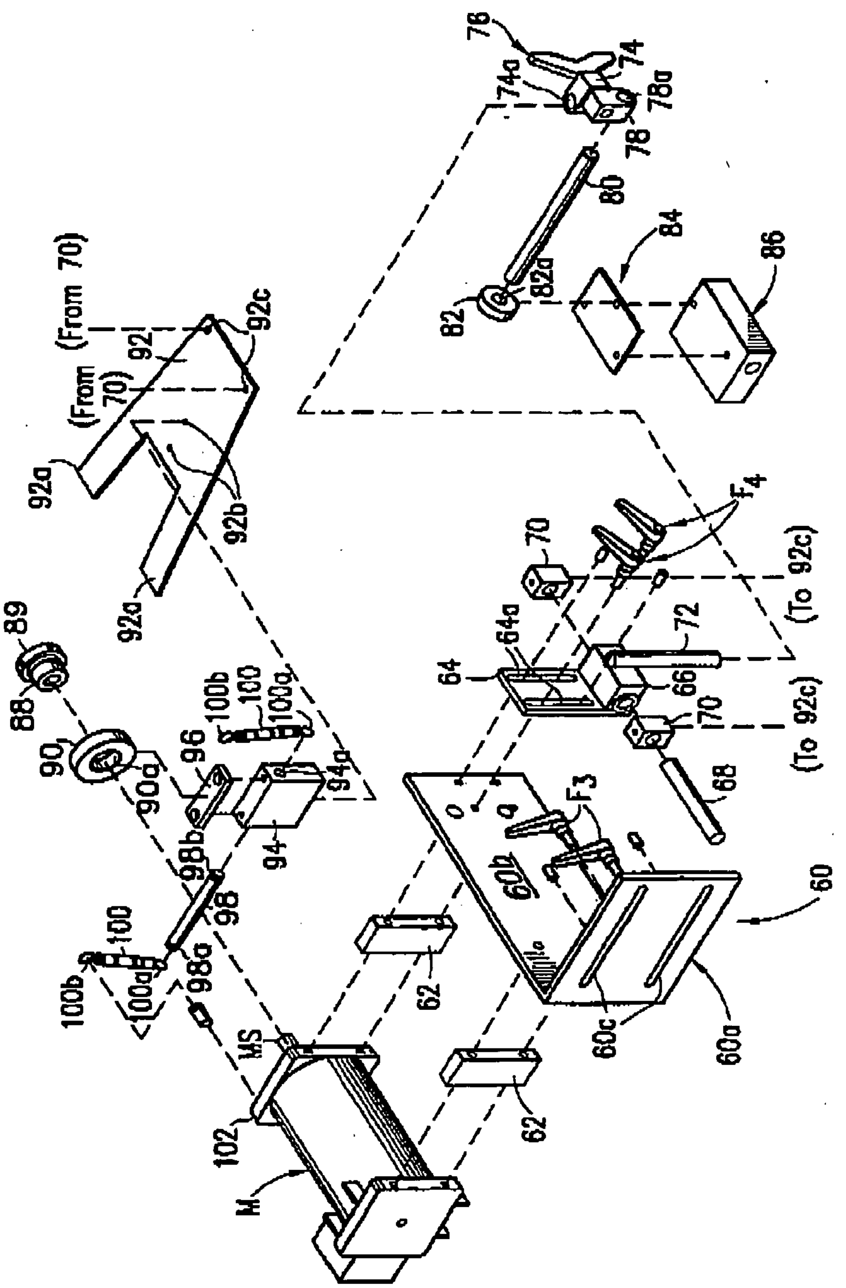
76
74
74a
78a
78
80
82a
82
84
86
(From 70)
(From 70)
92
92c
92a
92b
92a
89
88
90
90a
96
100b
100
100a
94a
94
98b
98
98a
100
100a
100b
MS
102
M
62
62
64
64a
70
F4
(To 92c)
72
66
70
(To 92c)
68
F3
60b
60
60c
60a

Fig. 3a

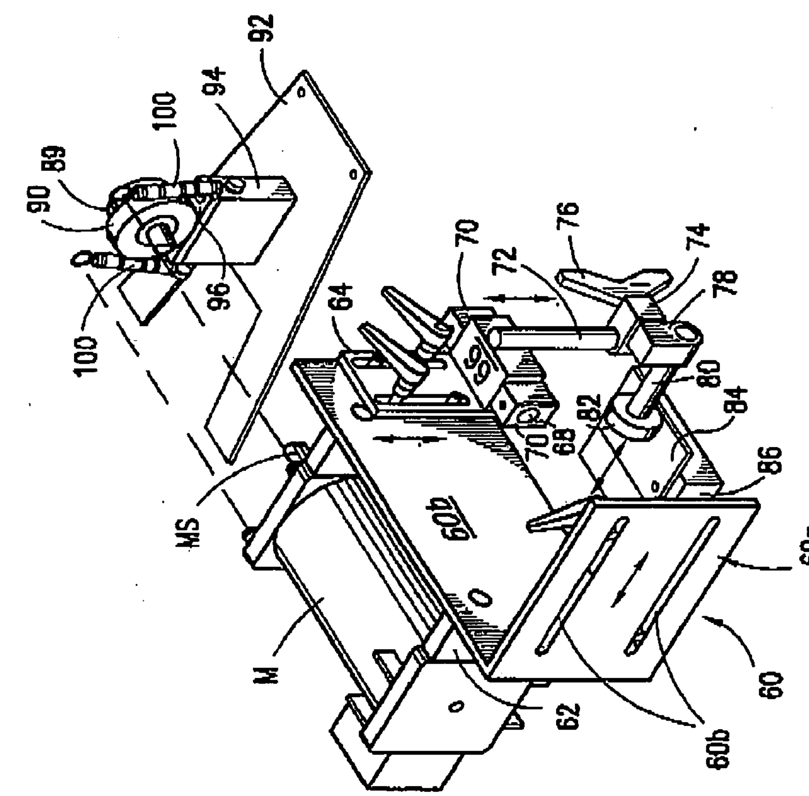
92
94
100
89
90
96
100
70
72
76
74
78
64
80
84
82
68
70
86
MS
60b
60a
M
62
60b
60

Fig. 3b

JOGGER HAVING A FLOATING MOUNT

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to copending application Ser. No. 978,994, filed Nov. 19, 1992, now U.S. Pat. No. 5,310,172, and application Ser. No. 693,638, filed Apr. 30, 1991, now U.S. Pat. No. 5,197,590, issued Mar. 30, 1993, both of said documents being assigned to the assignee of the present invention.

FIELD OF THE INVENTION

The present invention relates to joggers and more particularly to a novel floating mount for devices such as joggers for regulating the force applied to the top edges of signatures being jogged into alignment and preventing signatures from being curled.

BACKGROUND OF THE INVENTION

Vertical hopper loaders are well known in the art and are typically used in the printing and publishing field and are utilized to form neatly aligned stacks of signatures preparatory to being fed to saddle conveyors, bindery machines and the like. One typical hopper loader which may use the present invention to great advantage is described in copending application Ser. No. 978,994, filed Nov. 19, 1992 and assigned to the assignee of the present invention. For purposes of understanding the present invention, the vertical hopper loader of application Ser. No. 978,994, receives stacks of signatures typically manually placed upon a first, horizontal conveyor section. The signatures are tilted over so as to be substantially diagonally aligned and in a near-vertical position and are thereafter moved along a diagonally aligned conveyor path formed by a ramp conveyor section which causes the signatures to be fed in a shingle fashion at a speed which is the same as or faster than the speed of the horizontal conveyor with the folded edges extending upwardly and being spaced by an increased distance from the folded edge of adjacent signatures due to the diagonally upward movement. The conveyor path then changes whereupon the lower edges of the signatures are moved along a third, short conveyor path aligned so as to move the lower edges of the signatures either horizontally or diagonally downwardly toward a collection device typically inclined at an acute angle to the vertical.

As the signatures are advanced along the third, short conveyor path by virtue of a conveyor means engaging and driving the bottom edges of the signatures engaging the conveyor means to advance the signatures to the output utilization device, it is advantageous to provide a jogging means for jogging the top edges of the signatures to form a neat stack preparatory to delivery to the output utilization means to assure proper feeding.

Jogging is typically accomplished by employment of jogging means such as a beaver-tail jogger described in the aforementioned U.S. Pat. No. 5,197,590. Such beaver-tail joggers are adjustable, typically in at least two mutually perpendicular directions, to adjust the beaver-tail plate which undergoes oscillation to jog the stack of signatures therebeneath by repeated engagement with the upper folded edges of the signatures as they move along the third conveyor path.

Conventional beaver-tail joggers of the type described in U.S. Pat. No. 5,197,590 have the disadvantage of being substantially fixed in space, once adjusted,

so that signatures may be damaged or unnecessarily curled and/or the beaver-tail jogger drive assembly may be overloaded and possibly damaged due to changes in the nominal position of the top folded edges of the signatures.

BRIEF DESCRIPTION OF THE INVENTION

The present invention is characterized by comprising a novel four-bar parallelogram-type linkage assembly for floatingly mounting jogger assemblies and the like. The jogger assembly is swingably mounted upon a support post which serves as one "bar" of the four-bar assembly. First ends of a second "bar" and a third "bar" are swingably mounted to said post and a fourth "bar" has its ends pivotally coupled to the free ends of said second and third bars. A jogger assembly is coupled to the fourth bar by adjustable means for adjusting the position and angular orientation of the beaver-tail jogging plate relative to the top folded edges of a stack of forming signatures.

The aforementioned second bar is provided with an extension that extends away from the jogger assembly and which is provided with a mass which is movable along a slidable mount provided on the extension and includes releasable fastening means for maintaining the slidable mass in a predetermined position, said slidable mass at least partially counterbalancing the weight of the jogger assembly by an amount which is a function of weight of the mass and the position of the slidable mass along the extension rod.

Once the jogging plate is positioned at the desired orientation, the four-bar linkage assures that the jogging plate thereafter remains parallel to its original orientation regardless of any swinging movement up or down experienced by the linkage assembly. The weight or force of the jogging plate upon the top folded edges of the signatures is dynamically adjusted in the event that any changes occur in the position or positions of the top folded edges of signatures conveyed to the third and final conveying path of the hopper loader. This arrangement also operates as a safety feature which permits movement of the jogger assembly responsive to any impediment which may strike or be struck by the jogger plate and/or jogger.

Adjustably mounted sensing means is provided to activate the jogger assembly only in the presence of a signature stack to be jogged. Further sensing means are provided to deactivate the jogger assembly when the jogging assembly is lifted to a given position displaced from the nominal stack jogging position.

OBJECTS OF THE INVENTION

It is therefore one object of the present invention to provide a novel mounting assembly for floatingly mounting jogging assemblies and the like.

Still another object of the present invention is to provide a novel four-bar linkage for floatingly mounting jogger assemblies and the like.

Still another object of the present invention is to provide a novel mounting assembly for floatingly mounting beaver-tail joggers and the like.

Still another object of the present invention is to provide a novel assembly for floatingly mounting joggers, jogger assemblies and the like and incorporating a slidably mounted mass for adjusting the force exerted by the jogger assembly upon a stack of signatures being formed on an outfeed conveyor.

The above, as well as other objects of the present invention will become apparent when reading the accompanying description and drawings, in which:

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a simplified elevational view of a vertical hopper loader incorporating the floating top jogger assembly of the present invention;

FIG. 1a shows a simplified, diagrammatical view of the jogger mounting assembly of FIG. 1 which is useful in explaining the manner in which the orientation of the jogger assembly jogger plate is maintained regardless of swinging movement of the mounting assembly;

FIG. 2a is a detailed exploded perspective view of the support assembly of FIG. 1;

FIG. 2b is a detailed assembled perspective view of the support assembly of FIG. 2a;

FIG. 2c is a perspective view of guard plates employed with the floating support assembly of FIG. 2a; and

FIGS. 3a and 3b are exploded perspective and assembled perspective views of the jogger assembly.

DETAILED DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS THEREOF

FIG. 1 shows a simplified view of a vertical hopper loader 10 which includes a wheeled support frame 12 having a first substantially horizontally aligned conveyor section 14 for conveying signatures S in the direction shown by arrow A. A hopper loader suitable for use with the present invention is described in detail in U.S. Pat. No. 5,197,590 and incorporated herein reference thereto.

Stacks of signatures are typically manually placed upon the first conveyor section with their folded edges up. The signatures are maintained in a substantially diagonal alignment and move in the direction of arrow A toward a second conveyor section 16 which moves the signatures diagonally upward and to the right as shown by directional arrow B. Movement of signatures S along conveyor path 16 serves to separate adjacent signatures from one another preparatory to their movement to the final output conveyor section 18 which supports and engages the folded edges of signatures S with the cut edges being substantially aligned along the top of the group G of signatures being formed upon the upper run of conveyor section 18. The signatures are advanced by conveyor section 18 so as to be moved either horizontally or in a slightly diagonally downward direction as shown by arrow C.

The signatures S in the signature group G are incrementally stepped toward a limit plate 20 by apparatus described in detail in U.S. Pat. No. 5,197,590. Signatures are typically extracted, one at a time, once they reach the limit plate, for example, by suction means shown in U.S. Pat. No. 5,197,590 (see FIG. 6) and are fed to an output utilization device such as, for example, a bindery or stitching saddle. It is extremely important that each signature be accurately aligned upon arrival at limit plate 20 in order to be assured that it will be accurately picked up and fed to the output utilization device. The vertical hopper loader serves this function together with the jogger assembly 30 of the present invention. Although the first, second and third conveyor sections 14, 16 and 18 respectively provide a substantially neat alignment of signatures in group G as they are advanced to limit plate 20, the desired precise alignment is further assured through the use of jogger assembly 30 which employs a jogging plate 40 reciprocated by a drive motor 42 to move in the direction shown by double-headed arrow D to jog the top folded edges of signatures in group G as they are advanced in the direction shown by arrow C along conveyor section 18, thus, assuring that the top folded edges are substantially in perfect alignment preparatory to reaching limit plate 20.

Heretofore, jogger assemblies employing a jogging plate utilized adjustment means for adjusting the jogging plate according to the angular orientation as well as the distance of the jogging plate above the surface of conveyor section 18, which is a function of the height of the signatures being collected. One such jogger assembly and the adjustment means therefor is described in the aforementioned U.S. Pat. No. 5,197,590.

The present invention provides a novel floating assembly 30 which is of a four-bar linkage type and is comprised of a support post 34 having its lower end secured to the hopper loader support structure by suitable support means 35. A pair of "bars" 36 and 37 are swingably mounted to post 34 by pivots at their ends 36a, 37a. A fourth "bar" 38 has its upper end 38a pivotally coupled by suitable coupling means 36f, 46 to the free end 36b of bar 36 (see FIG. 2a). The lower end 38b of bar 38 is pivotally coupled by coupling means 38f, 46 to the right-hand, free end 37b of bar 37 (see FIG. 2a).

Bar 36 is provided with an extension 39 extending to the left of support post 34 and provided with a mass 41 which is mounted to slide in either of the two directions shown by arrows E, F. Releasable fastening means (to be more fully described) serve to maintain mass 41 at any desired position along the permissible length of travel provided by means to be more fully described.

Adjustment means, to be more fully described, permit adjustment of the jogging plate shown by double-headed arrows H, I and J in FIG. 1a.

Assuming the orientation of the plate 40 to be as shown in FIG. 1a, the novel operation of the four-bar linkage is as follows:

Omitting the description of extension bar 39 and slidable mass 41 for the moment, the pivotal mounts MP_1 through MP_4 provided to swingably mount each of the bars to at least two associated adjacent bars cause the assembly to swing clockwise about the pivotal mounts MP_1, MP_4 coupling bars 36 and 37 to post 34 due to the weight of the linkage assembly as well as the weight of the jogger assembly mounted thereto.

Any irregularities or differences along the top edges of the signatures within group G (see FIG. 1) will exert an upward force against jogging plate 40 causing the plate to move upwardly. The pivotal mounts MP_1 through MP_4 freely permit this movement, further preventing the signatures from either being damaged or unduly curled.

The movement of arms 36 and 37 in either the clockwise or the counterclockwise direction has no effect whatsoever upon the angular orientation of bar 38 which remains parallel to vertically aligned post 34 regardless of the amount or direction of angular movement experienced by bars 36 and 37 within the normal range of movement. As a result, the surface of jogging plate 40 likewise always remains parallel to its nominal position, shown in solid line fashion in FIG. 1a.

Force exerted upon the top edges of signatures in the group G is a function of the weight of bars 36, 37 and 38 as well as the jogger assembly 30. This force may be

counterbalanced and/or reduced by adjustment of slidable mass 41 with the counterbalancing force being a function of the weight of mass 41 and the distance of mass 41 from the upward pivotal mount MP_1 joining extension 39 and bar 36 to post 34. This arrangement permits the force exerted by the jogger assembly 30 upon the top folded edges of the signatures to be adjusted within predetermined limits. For example, in one preferred embodiment, the force exerted by plate 40 upon the top edges of the signatures in group G may be altered from a range of from one ounce to five pounds.

FIG. 2a shows a detailed exploded view of the support assembly 30 and FIG. 2b shows a detailed assembled view, both in perspective, of the jogger assembly floating support in which like numerals as between FIGS. 1 and 1a and FIGS. 3a and 3b designate like elements.

The lower end of support post 34 is swingably mounted in a cup-shaped support 35 having a flat surface 35a joined to the hopper loader frame 14 as shown in FIG. 1. U-shaped member 33 is secured to frame 12 (see FIG. 1) to further support post 34 and prevent rotation about its longitudinal axis. The side walls 37c, 37d of arm 37 are pivotally mounted to block 45 arranged at a predetermined position along post 34. Fasteners F retain block 45 at the desired position. Fasteners such as 36a-1, which include a collar 46, swingably mount the right-hand end of arm 37 to block 45. The side walls 36c, 36d of arm 36 are mounted to a similar block 48 secured at a predetermined height along post 34 by fasteners F_1. "Bar" 38 is a channel-shaped member having sides 38c, 38d arranged on opposite sides of bars 36 and 37. Fasteners 36f, 38f couple the channel side 38d to bars 36 and 37. Side 38c is secured to the opposite sides of bars 36 and 37 in a similar manner and utilizing similar fasteners (not shown for purposes of simplicity). Collars 46 provide the desired pivotal motion of bars 36, 37 and 38. Spacers 49 are arranged to span between the vertical sides 36c, 36d of channel-shaped bar 36 and 37c, 37d of channel-shaped bar 37.

Cut-out portions 36e and 37e in the top surface of channel-shaped bars 36 and 37 provide adequate clearance for mounting blocks 45 and 48 to permit the linkage assembly to move along its normal swing path between position 30 and 30' (see FIG. 1a) without interference.

Extension 39 of bar 36 is integral with bar 36 and is a channel-shaped member provided with elongated slots 39a, 39b along side surface 39c. Similar slots (not shown) may be provided along side surface 39d. An elongated slot 39e is provided in the top surface 39f of channel-shaped extension 39. Mass 41 is slidably mounted between the sides 39c and 39d of channel-shaped extension 39 and is adjustable over a predetermined distance which is equal to the length of the slots 39a, 39b, 39e, the length of these slots being equal to one another.

A permanent magnet member 52 is secured to bracket 50 which in turn is positioned to span between sides 39c and 39d of extension 39. Suitable fastening means (not shown) secure bracket 50 to extension 39. Fastening means F_2 secure permanent magnet 52 to mounting bracket 50.

A switch PS is mounted upon mounting block 44 (see FIG. 2b) and is activated by permanent magnet 52 when the four-bar linkage is pivoted counterclockwise in order to lift the jogger assembly upward and away from the signature stack being formed (see dotted line position 30' in FIG. 1a), the lifting of bars 36, 37, and 38 causing the lowering of extension 39 to position the permanent magnet 52 in close proximity to switch PS which automatically turns off the jogging assembly. The proximity switch PS activates to turn off motor M (see FIG. 3a) when the extension forms an angle of the order of 15° with vertical post 34.

Channel-shaped "bar" 38 is provided with mounting openings 38e in side wall 38c for adjustably mounting the jogger assembly to be more fully described in connection with FIGS. 3a and 3b.

FIGS. 3a and 3b show a jogging assembly 42 which is comprised of an L-shaped mounting bracket 60 having elongated slots 60c provided in arm 60a. Adjustable fasteners F_3 threadedly engage tapped openings 38e in side 38c of channel 38 shown in FIG. 2a to adjustably mount bracket 60 to channel-shaped bar 38. Motor M is mounted upon a pair of mounting blocks 62, 62 which are in turn secured to the arm 60b of bracket 60.

A bracket 64 is slidably mounted on the surface of bracket arm 60b opposite the surface facing motor M and is provided with elongated slots 64a for receiving adjustable fasteners F_4 for adjusting the vertical position of bracket 64 along bracket arm 60b to thereby adjust the angular orientation of jogging plate 92 as will be more fully described. A solid block 66 is integrally joined to bracket 64 and is provided with a substantially horizontally aligned elongated opening for slidably receiving rod 68 which is held between a pair of blocks 70, 70.

Blocks 70, 70 are secured by suitable fasteners (not shown) to the right-hand end of jogging plate 92, the fasteners extending through mounting openings 92c in plate 92. Plate 92 and blocks 70, 70 are swingable about the longitudinal axis of rod 68 which freely rotates relative to block 66. The position of bracket 64 relative to the motor output shaft MS determines the angular orientation of jogging plate 92.

An elongated rod 72 has its upper end joined to the right-hand surface of block 66 and extends downwardly and through an opening 74a in adjustable block 74 which is provided with a fastener 76 having a butterfly-shaped adjustment head to adjust the position of block 74 along vertically oriented rod 72. Block 78 is integrally joined to one face of block 74 and is provided with an opening 78a for receiving the right-hand end of an elongated rod 80 whose left-hand end extends into an opening 82a in disk-shaped member 82. Plate 84 secures disk-shaped member 82 to a sensing means 86 which projects a signal toward the stack of signatures building on conveyor section 18 (see FIG. 1) and is provided with a sensor for detecting a signal reflected off the surface of a signature to maintain the jogging assembly energized. When the signatures are greater than a predetermined distance from the sensor, the sensor deenergizes the jogger assembly to thereby provide operation of the jogging plate only when signatures are in the region of influence of the jogging plate. Adjustable blocks 74 and 78 permit adjustable movement of the sensing means 86 in mutually perpendicular directions in order to adjust the sensor according to the size of signatures being collected and jogged.

Motor shaft MS of motor M has mounted thereto an eccentric 88 which extends through the center 90a of ring-shaped member 90. Flange 89 at the free end of eccentric 88 retains the ring-shaped member 90 on eccentric 88.

The jogging plate 92, referred to as a "beaver-tail" due to its shape, is mounted to the underside of block 94 by suitable fasteners cooperating with openings 92b. A plate 96 is secured by suitable fasteners to the upper surface of block 94 and engages the periphery of ring-shaped member 90. An elongated rod 98 extends through a horizontally aligned opening 94a in block 94. A pair of tension springs 100 each have their lower ends 100a secured to opposite ends 98a, 98b of elongated rod 98 which rod ends extend beyond the adjacent vertical sides of block 94. The upper ends 100b of tension springs 100 are secured to a mounting plate 102 at the right-hand end of motor M. Thus, block 94 and hence the jogging plate are resiliently urged toward the ring-shaped member by springs 100.

Energization of motor M rotates eccentric 88 causing the bifurcated ends 92a of beaver-tail plate 92 to rotate in a reciprocating manner about pivot rod 68 to repeatedly strike the top edges of the jogger signatures as shown in FIG. 1 and thereby bring the signatures into precise alignment in readiness for take away of each signature as it reaches the limit plate 20.

The force exerted upon the top edges of the signatures by jogging plate 92 is a function of the weight of the jogger assembly and four-bar linkage.

This force is at least partially counterbalanced by adjustment of the slidable mass 41 along extension arm 39 whereby movement of mass 41 further away from post 34 increases the moment arm defined by mass 41 and extension arm 39 to counterbalance at least a portion of the force exerted by the jogging plate 92 (FIG. 3a) upon the signatures.

A safety shield 104 shown in FIG. 2c is secured to bracket 60b and acts as a safety shield to protect operators from injury by preventing operators from inserting a finger, hand or arm into the open region surrounded by the members 36, 37 and 38 of the linkage assembly which collapse when the support assembly moves to the upper, displaced position, reducing the size of the opening region.

The jogging plate 92 (FIG. 3a) may be adjusted to accommodate signature runs of different sizes. Once the jogging plate is adjusted, the jogging plate is maintained parallel to its initial adjustment position regardless of the swinging motion experienced by the linkage about pivot blocks 45 and 48. The freewheeling mounting assembly enables the jogging assembly to be freely lifted up in the event of any blockage or obstruction in the path of the jogging plate.

The sensing means 86 permits motor M to be energized only in the presence of signatures on conveyor section 18 and in the absence of signatures automatically turns motor M off. The jogging assembly may be easily lifted upward for inspection, maintenance or any other purpose whereupon movement of extension arm 39 to form an angle of the order of fifteen degrees (15°) with post 34 causes permanent magnet 52 to activate the proximity switch PS to automatically deenergize motor M when the jogging assembly is lifted upward and away from the jogging region.

A pair of guards 54, 56 are mounted on opposite sides of the four-bar linkage and have mounting members 55 and 57 which snap onto the heads of shoulder bolts 36f, 37f on opposite sides of the four-bar linkage in order to protect operating personnel.

The floating assembly 30 may be employed in any application where it is desired to maintain orientation of an element or device throughout a range of swingable movement as well as at least partially counter-balancing the weight of such element or device. For example, the element may be a feeler arm for sensing the top, side or bottom edges of a stack, a collector or a dispenser for a liquid, etc.

A latitude of modification, change and substitution is intended in the foregoing disclosure, and in some instances, some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein described.

What is claimed is:

1. Jogger means for use in forming a neat stack of signatures as they are moved along conveyor means for receiving signatures in side-by-side, substantially upright fashion, wherein said signatures are arranged with major faces of adjacent signatures in engagement and being inclined at a slight angle to the vertical;

said jogger means including in combination:

a reciprocating jogging member engaging upper edges of signatures as they move onto said conveyor means for maintaining a neat, orderly alignment of the signatures as they move from an input end to and output end of the conveyor means;

a support assembly for adjustably mounting said jogging member at a preselected orientation, said support assembly being comprised of:

a support post;

a mounting assembly for floatingly mounting said jogging member being swingably mounted upon said post; and

said mounting assembly including means for maintaining said jogging member at a predetermined orientation even when said mounting assembly swingably moves relative to said support post.

2. The jogger means of claim 1 wherein said means for maintaining comprises a four-bar linkage assembly.

3. The jogger means of claim 1 wherein said means for maintaining comprises a parallelogram linkage assembly.

4. The jogger means of claim 1 wherein said means for maintaining comprises a linkage assembly comprised of a pair of arms each having a first end pivotally mounted to said post a given distance from one another by first and second pivotal couplings;

a third arm having a first end pivotally coupled to a second end of said first arm at a third pivotal coupling and having a second end pivotally coupled to a second end of said second arm at a fourth pivotal coupling; and

the spacing between said four pivotal couplings being chosen to form a parallelogram linkage, so that said third arm remains substantially parallel to said post even as said first and second arms swing relative to said post.

5. The jogger means of claim 1 wherein said means for maintaining comprises a linkage assembly comprised of a pair of arms each having a first end pivotally mounted to said post a given distance from one another by first and second pivotal couplings;

a third arm having a first end pivotally coupled to a second end of said first arm at a third pivotal coupling and having a second end pivotally coupled to a second end of said second arm at a fourth pivotal coupling; and

the spacing between said four pivotal couplings being chosen to maintain said third arm substantially

parallel to said post as said first and second arms swing relative to said post.

6. The jogger means of claim 5 wherein said jogging member is adjustably mounted to said third arm.

7. The jogger means of claim 5 further comprising:
said jogging member being a jogger paddle;
a support bracket adjustably mounted upon said third arm;
a motor mounted on said bracket and having a rotatable output shaft;
means coupled between said motor output shaft and said jogger paddle for converting rotation of said output shaft into reciprocating motion for reciprocating said jogger paddle.

8. The jogger means of claim 7 further comprising:
manually operable means mounted to said bracket for adjusting the position of at least one of said paddle and said motor for adjusting a spacing distance of said paddle relative to a conveying surface of said conveyor means.

9. A jogger assembly for jogging upper edges of signatures as they are moved along a substantially horizontal path defined by a conveyor with major faces of signatures on said conveyor in engagement;
said jogger assembly comprising in combination:
a jogging member engaging top edges of said signatures and means for reciprocating said jogging member to jog signatures on said conveyor into alignment;
a support assembly for floatingly mounting said jogging member and said means for reciprocating including amounting post;
said support assembly including a support means swingably mounted to said post at a location intermediate opposing ends of said support means;
said jogging member being adjustably mounted at one of said opposing ends;
a mass movably mounted to said support means and slidable along said support means in a region between said intermediate location and an end of said support means opposite from the end supporting said jogging member; and
means for releasably maintaining a position of said movable mass to adjustably counterbalance at least a portion of the force exerted upon said one of said opposing ends.

10. The jogger assembly of claim 9 wherein said swingably mounted support means is movable to move said jogging member between a lower position for engaging and jogging signatures and an upper position displaced from the jogging position; and
sensor means mounted on said mounting post for sensing a position of said support means for deenergizing said means for reciprocating when said support means is in the upper displaced position.

11. The jogger assembly of claim 9 wherein said support means further includes means for maintaining said jogging member in a given orientation over a range of swingable movement of said jogging member between a lower and upper position.

12. The jogger assembly of claim 9 further comprising a sensor means adjustably mounted upon said support means for sensing the presence of signatures on said conveyor and including means for energizing said means for reciprocating only when signatures are present on said conveyor.

13. The jogger assembly of claim 11 wherein said means for maintaining a given orientation of said jogging member comprises a four-bar linkage assembly.

14. The jogger assembly of claim 11 wherein said means for maintaining a given orientation of said jogging member comprises a parallelogram linkage assembly.

15. The jogger assembly of claim 9 further comprising means for adjustably mounting the jogging member on said support means for adjusting the position of the jogging member to accommodate signatures of different sizes.

16. In combination, a jogging device and a support assembly for floatingly mounting said jogging device for aligning a stack of mounting signatures arranged with one of their edges supported upon a conveying surface and with opposite parallel edges extending upwardly from the conveying surface;
said support assembly including a mounting post;
said support assembly further including elongated support means swingably mounted to said post at a location intermediate opposing ends of said support means;
said jogging device comprising:
a jogging member and means for reciprocating said jogging member at a regular rate for aligning said stack of signatures being adjustably mounted at one of said opposing ends to float above the opposite edges of said stack, said support means including means for maintaining a spatial orientation of said jogging member throughout a range of swinging movement of said support means.

17. The combination of claim 16 further comprising:
said device being a jogger assembly;
a mass movably mounted to said support means and slidable along said support means in a region between said intermediate location and an end of said support means opposite from the end supporting said jogging device; and
means for releasably maintaining a position of said movable mass to adjustably counterbalance at least a portion of the force exerted by said jogger assembly upon said signatures.

18. The combination of claim 16 wherein said means for reciprocating comprises an electric motor having an output shaft;
an eccentric rotated by said output shaft;
a toroidal-shaped roller rollingly engaging said eccentric;
said jogging member comprising a paddle-shaped member;
a support block joined to said paddle-shaped member;
resilient means urging said toroidal-shaped member into engagement with said support block; and
means for pivotally mounting said paddle-shaped member whereby energization of said electric motor causes said paddle-shaped member to reciprocate about said pivotal mounting means.

19. The combination of claim 16 further comprising:
sensor means for sensing the presence of signatures for selectively operating said means for reciprocating; and
means for mounting said sensor means to said support assembly comprising means for adjustably positioning a height of said sensor and a distance of said sensor relative to said support assembly.

20. The combination according to claim 19 wherein said means for adjustably positioning comprises a mounting bracket mounted to said mounting assembly;

a first rod extending downwardly from said mounting bracket;

a member adjustably positioned along said first rod;

a second rod secured to said adjustably positionable

member and oriented so as to be perpendicular to said first rod; and

means for positioning said sensor along a length of said second rod.

* * * * *